HEAVY FILLER IN GOLF BALL CORES

Cross-Reference to Related Application

A claim of benefit is made to U.S. Provisional Application Ser. No. 60/093,229 filed July 17, 1999, the contents of which are incorporated herein by reference.

Background of the Invention

1. Field of the Invention

The invention relates generally to compositions for golf balls. More specifically, the invention relates to fillers for golf ball centers and cores.

2. Description of the Related Art

One of the parameters of golf ball performance that receives great attention is flight distance. Although there are a variety of factors that influence a golf ball's flight distance, perhaps the most important factor relates to the rebound characteristics of the ball which is dictated in large part by the materials used to construct the golf ball.

As is well known in the industry, there are a number of different types of golf balls. The predominant varieties are a two-piece and a three-piece golf ball. A two piece golf ball is typically constructed with a solid core and a cover. A three-piece ball is typically a thread wound solid center with a cover. Within these two broad categories are numerous variations such a liquid filled centers for three-piece balls. Regardless of the particular golf ball type, all golf balls have rebound characteristics that are dictated by the materials and construction type utilized.

To conform to United States Golf Association ("U.S.G.A.") guidelines and regulations, golf balls have to be constructed to meet specific weight requirements. When a golf ball core or center composition is below specified weight requirements, one of the techniques used to increase weight is to add fillers to the centers and cores of three-piece golf balls and two-piece golf balls, respectively. Conventional fillers used include calcium carbonate (specific gravity of 2.73), barium sulfate (sp. gr. of 4.3) and zinc oxide (sp. gr. 5.6). Although these materials can be effectively used to increase the weight of a golf ball, the inevitable volume occupied by these materials when incorporated into a center or core results in a reduction in the polymer/rubber content of the center or core. By extending the rubber with fillers or reducing the polymer/rubber content, the coefficient of restitution of the resulting golf ball is reduced which translates into reduced flight distance.

The compression of a golf ball is a measure of the deflection of the golf ball under a load of 200 lbs. The Professional Golf Association (PGA) measures compression as (0.180" - deflection) x 100. Typically, the lower the PGA compression the softer the golf ball. The softer golf ball (with a softer core and/or cover) exhibits better feel, click and spin characteristics when compared with a high compression golf ball.

An additional detrimental side effect of high stiffness content is that a high loading of fillers stiffens the rubber compound and increases the compression of the core or center while reducing the resilience properties.

It has now been discovered that the incorporation of high density materials

such as tungsten into cores and centers can be used to meet golf ball weight requirements without significantly reducing the coefficient of restitution or increasing the compression of the golf ball produced. In some instances, the opposite effect has been observed.

It is thus an object of the invention to provide a golf ball center or core composition that uses high specific gravity fillers in order to maintain the weight of a conventional golf ball core or center having a lower compression without significantly compromising the resilience characteristics of the golf ball in which such a center or core is incorporated. A further object is to meet the USGA golf ball weight requirements without increasing the golf ball compression.

Summary of the Invention

The invention described herein relates to the addition of high density inorganic powders of metals and oxides that can be used to increase the weight of a center for a two-piece golf ball and the core of a three-piece wound golf ball without significantly compromising the rebound characteristics of the golf ball produced. The fillers used have a high specific gravity of about 5.4 and higher.

These objects and features of the present invention will be apparent from a review of the drawings and a reading of the following detailed description of the invention.

Brief Description of the Drawings

FIG. 1 is a cross section of a three-piece golf ball according to one embodiment of the invention.

FIG. 2 is a cross section of a two-piece golf ball according to one embodiment of the invention.

Detailed Description of the Invention

As is well known in the art, fillers can be incorporated into golf ball cores and centers to increase the weight of the resulting golf ball. It has now been discovered that the utilization of high density fillers having specific gravities of about 5.4 or greater can be used to increase the weight of a golf ball center **1** (as shown in FIG. 1), or core **1a** (as shown in FIG. 2) without significantly reducing the rebound characteristics of the resulting golf ball which further comprises cover **2**.

The following table contains a list of high density inorganic elements that meet the aforementioned criteria. The list is provided by way of illustration and not limitation. The key criteria is that the filler material must have a specific gravity of at least about 5.6.

Table 1

Inorganic Element	Specific Gravity
Tungsten	19.3
Bismuth	9.8
Copper	8.9
Bismuth oxide	8.9
Nickel	8.9
Cobalt	8.9
Iron/Steel	7.7
Tin	7.3
Chromium	7.2
Zinc	7.1
Bismuth subcarbonate	6.9
Cupric oxide	6.4
Barium tungstate	6.4
Cuprous oxide	6.0
Ferrous oxide	5.7

In one embodiment, centers or cores incorporating such fillers are prepared by dry mixing polybutadiene rubber with the filler of choice and other rubber vulcanizing ingredients to create the desired blend. Mixing can be accomplished in an internal mixer such as a Banbury mixer or an open mill as is well known in the art. The mixture is then sheeted and allowed to cool for preferably 8 hours minimum.

The sheeted material is then placed in a warm up mill and heated to about between 110°F to 160°F. The sheets are then stripped off the mill of desired thickness and width and fed into an extruder. A die of desired geometric shape converts the sheets into extrudate which is cut into plugs of desired weight. The plugs are then optionally fed into a duster to dust the plugs to prevent the plugs from adhering to each other.

Next, the plugs are placed into compression molds for final forming. For purposes of forming golf ball cores or centers, the plugs are heated under pressure in the molds to preferably at least 290°F as is well known in the art to ensure peroxide activation. The molded cores or centers are maintained in the molds until cured. As is well known in the art, the amount of time needed to cure the cores and centers is a product of the peroxide activity. The end result is a core or center having the desired diameter.

The following examples are illustrative of the advantages obtains by using high density fillers. The amounts of compound components are specified as being parts per hundred parts by weight of rubber unless specified otherwise. As used herein, "high cis" shall mean a cis content of 92% or greater. The same specific gravity was maintained for all three compounds to give the same weight after molding of the cores. Only part levels of the weight enhancing filler was varied in the compound.

Example 1

COMPOUND	A	B	C
High cis polybutadiene	100	100	100
Zinc diacrylate	29.5	29.5	29.5
Zinc oxide	5	5	5
Zinc stearate	3	3	3
Core regrind	7.5	7.5	7.5
Peroxide	2.125	2.125	2.125
Calcium carbonate (2.73)	20.805	-	-
Zirconium dioxide (5.50)	-	15.285	-
Tungsten (19.3)	-	-	12.875
Total	167.930	162.410	160.000
Compound specific gravity	1.139	1.139	1.139
Volume occupied by filler (%)	5.17	1.95	0.48
CORE DATA:			
Size (inches)	1.54	1.54	1.54
Weight (g)	36.7	36.8	36.7
Compression (PGA)	95.7	89.3	83.0
Coefficient of restitution	0.695	0.697	0.702
BALL DATA:			
Size (inches)	1.68	1.68	1.68
Weight (g)	45.3	45.2	45.1

Compression (PGA)	103.6	97.3	93.2
Coefficient of restitution	0.703	0.706	0.706
FLIGHT DATA:			
Driver; carry (yards)	245.5	245.7	246.3

As clearly demonstrated by the test results, the use of heavy weight fillers results in a desirable lower PGA compression and a higher coefficient of restitution relative to a core or center made with a filler having a lower specific gravity. When a filler having a relatively low specific gravity is used, inevitably more filler has to be used to meet the desired weight range for the core or center. The increased amounts of filler results in the reduction of other compound components. It is this reduction that leads to the increase in PGA compression and decrease in coefficient of restitution.

It will be appreciated that the instant specification and claims are set forth by way of illustration and made without departing from the spirit and scope of the present invention. Having thus described my invention, what I claim as new and desire to secure by United States Letters Patent is: